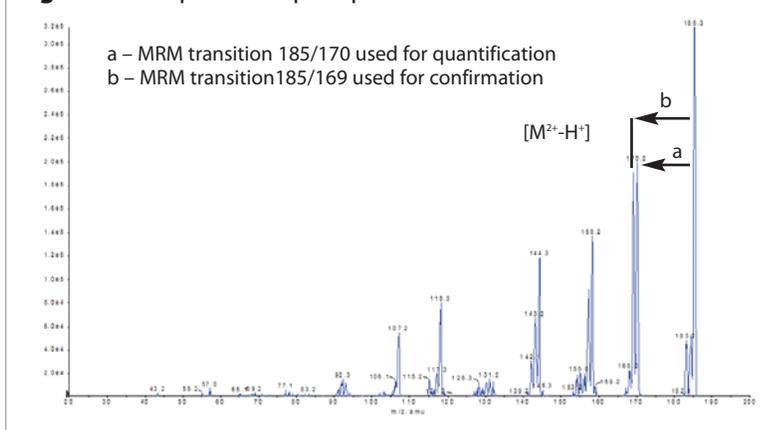




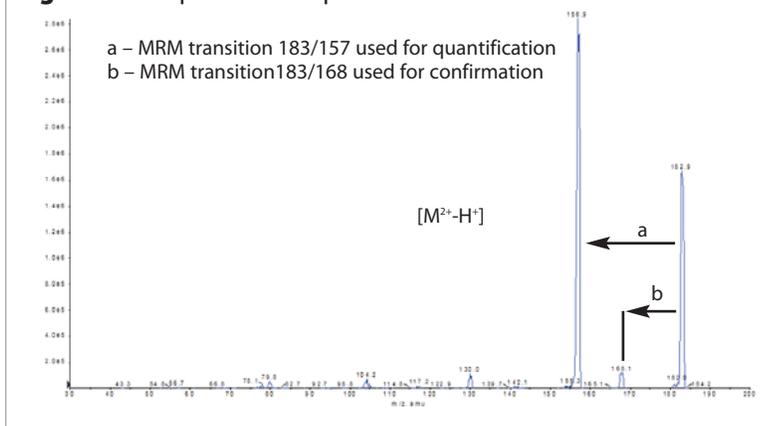
**Table 1** MRM transitions and MS conditions used to generate CID spectra for paraquat and diquat.

Precursor Ion (m/z)	Fragment Ions (m/z)	DP (V)	Collision Energy (eV)
Paraquat [ $M^{2+} - H^+$ ] 185	170a 169b	40	30
Paraquat-d8 [ $M^{2+} - D^+$ ] 193 (int. std.)	178a	40	30
Diquat [ $M^{2+} - H^+$ ] 183	157a 168b	35	30
Diquat-d4 [ $M^{2+} - D^+$ ] 186 (int. std.)	158a	35	30

**Figure 2** CID spectra for paraquat<sup>+</sup> at CE = 25eV.



**Figure 3** CID spectra for diquat<sup>+</sup> at CE = 25eV.



dissociation (CID) is used to generate the fragment ions. CID spectra for paraquat and diquat are shown in Figures 2 and 3. This approach has been used in many pharmaceutical and environmental applications, to generate unmatched limits of detection or quantification, precision, and accuracy. For accurate quantification, we used paraquat-d8 and diquat-d4 as internal standards (Table 1), to compensate for matrix effects and to correct for random and systematic errors in separation and detection.

For triplicate injections of 8 concentrations of analytes in deionized water and in lake water, from 5µg/100mL to 100µg/100mL for paraquat and from 0.1µg/100mL to 100µg/100mL for diquat, correlation coefficients for calibration curves were >0.995, using a linear fit and 1/x weighting factor. These results indicate that quantification can be performed with good linearity and sensitivity. Minimum detection limits (MDL) for the method, for paraquat and diquat in deionized water, were 5µg/L and 0.1µg/L, respectively.

LC/MS is a powerful tool for analyses of challenging environmental contaminants. In LC/MS analyses of paraquat and diquat, the combination of an Applied Biosystems API 3200™ mass spectrometer and an Ultra Quat HPLC column ensures fast, sensitive, and accurate results.

#### Reference

1. *Simple, Sensitive HPLC/UV Analysis for Paraquat and Diquat, Using High-Recovery Solid Phase Extraction and an Ultra Quat HPLC Column* Applications Note 580006, Restek Corporation, Feb. 2006. Reference available from Restek on request.

#### Ultra Quat Columns & Guard Cartridges

<b>5µm Column, 4.6mm</b>	<b>cat. #</b>
150mm	9181565
150mm (with Trident™ Inlet Fitting)	9181565-700
<b>Ultra Quat Guard Cartridges</b>	
10 x 2.1mm	918150212
10 x 4.0mm	918150210
20 x 2.1mm	918150222
20 x 4.0mm	918150220

#### Paraquat & Diquat Calibration Mix

diquat dibromide	paraquat dichloride
1,000µg/mL each in water, 1mL/ampul	
cat. # 32437 (ea.)	

## free literature

### Simple, Sensitive HPLC/UV Analysis for Paraquat and Diquat Using High-Recovery Solid Phase Extraction and an Ultra Quat HPLC Column

These highly charged quaternary amines are poorly retained on alkyl stationary phases. Using only acetonitrile, water, and a solvation-blocking reagent, our separation system alters the interactions among analyte, mobile phase, and stationary phase, and promotes solubility of the analytes in the stationary phase. In our system, the detection limit is 6ppb for either herbicide, and the analysis is completed in less than 10 minutes. An optimized solid phase extraction cartridge concentrates the herbicides for the analysis. **lit. cat.# 580006**

### Environmental HPLC: Applications-Columns-Reference Materials

Restek HPLC columns support environmental HPLC applications with rapid analysis times and effective analyte resolution. Sample turn-around can be 50% faster, or more, than with alternative columns. In addition, we prepare analytical reference materials and sample clean-up products for these methods. Applications in this publication include polyaromatic hydrocarbons, carbamates, phenoxyacid herbicides, explosives, carbonyls, and paraquat/diquat. **lit. cat.# 59741A**

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### HPLC Essentials

Genuine Restek Replacement Parts will keep your Agilent, Beckman, Hitachi, PerkinElmer, Shimadzu, Thermo Separation Products, or Waters system running smoothly and chromatography sharp. Restek parts equal or exceed the performance of original components. **lit. cat.# 59012A**